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ARS 849 (2012) (English): Reduction of acrylamide in potato products – Code of practice

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Reduction of acrylamide in potato products — Code of practice

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Foreword

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This African Standard was prepared by the ARSO Technical Harmonization Committee on Agriculture and Food Products (ARSO/THC 1).

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Introduction

Acrylamide (also called acrylic amide derived from acrylic acid) is a chemical compound mainly formed in food by the reaction of asparagine (an amino acid) with reducing sugars (particularly glucose and fructose) as part of the Maillard Reaction. Acrylamide formation primarily takes place under conditions of high temperature (usually in excess of 120 °C) and low moisture. It is a suspected human carcinogen and a neuro-toxicant.

This code addresses issues that are specific to acrylamide presence and control in order to guarantee production of safe and wholesome potato products. It focuses on Good Agricultural Practices (GAPs) and Good Manufacturing Practices (GMPs) that will help control acrylamide levels associated with all stages of production, handling and processing of potato products.

The objective of this code of practice is to provide consumers and processors with the recommended practices that can be undertaken to reduce the level of formation of acrylamide in potato products. Specific emphasis is placed on the quality of raw materials and processing condition, control of other ingredients and food processing.

Reduction of acrylamide in potato products — Code of practice

1 Scope

This African Code provides recommended practices for reducing the formation of acrylamide in potato products.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ARS 53, *General principles of food hygiene — Code of practice*

ARS 56, *Prepackaged foods — Labelling*

WD-ARS 847:2012, *Fresh potato tubers — Specification*

CODEX STAN 192, *General standard for food additives*

3 Definitions

For the purpose of this standard the following definitions apply.

3.1
acrylamide
white odourless crystalline solid chemical compound with chemical formula C_3H_5NO which is soluble in water, ethanol, ether and chloroform

3.2
package
any form of packaging material, which completely or partially encloses the food (including wrappers).

3.3
on-pack label
includes any tag, brand, mark, pictorial, or other descriptive script, written, printed, marked, embossed or impressed on, or attached to the package.

3.4
lot
food produced during a period of time and under more or less the same manufacturing condition identified by a unique code.

3.5
par-cooking
technique of partially cooking foods so that they can be finished later.

4 General considerations in developing preventative measures

4.1 Measures aimed at reducing levels of acrylamide should not be taken in isolation from other considerations. Precautions need to be taken in accordance to ARS 53 to avoid compromising the existing physical, chemical and microbiological safety of the food. The nutritional qualities of products also need to remain unimpaired, together with their organoleptic properties and associated consumer acceptability. The following precautionary measures need to be taken into account:

a) When preventative measures for acrylamide are considered, checks should be made to ensure that they will not result in an increase in other process contaminants. These include N-nitrosamines, polycyclic aromatic hydrocarbons, chloropropanols, ethyl carbamate, furan, heterocyclic aromatic amines and amino acid pyrolysates;

b) Preventative measures devised for acrylamide shall not compromise the microbiological stability of the final product. In particular, regard needs to be paid to the moisture content of the final product; and

c) Precautions should be taken to avoid detrimental changes to the organoleptic properties of the final product. The formation of acrylamide is intimately associated with the generation of the characteristic colour, flavour and aroma of cooked foods. Proposed changes to cooking conditions, or indeed raw materials and other ingredients, shall be assessed from the perspective of the acceptability of the final product to the consumer.

4.2 Processing aids such as asparaginase for prevention of acrylamide formation may only be used after regulatory approval based on formal safety assessments and efficacy-in-use.

NOTE 1 The extent of acrylamide formation can be quite variable e.g. within a production batch made at the same manufacturing plant, or between plants using the same process, ingredients and formulations.

NOTE 2 Variability in composition incoming raw materials and poor temperature control of heating devices can complicate trials of mitigation strategies, by obscuring changes in acrylamide levels.

5 Recommended practices for the reduction of acrylamide formation

5.1 Raw materials

Potatoes intended for processing shall comply with the requirements specified in WD-ARS 847:2012 and the factors that influence reduction of sugar levels in potato as described under 5.1.1 – 5.1.7 shall be taken into consideration.

5.1.1 Fertilizer application rate

This factor is known to influence levels of reducing sugars. Thus producers are advised to adopt appropriate fertilizer application regimes that yield suitable potatoes for processing.

5.1.2 Cultivar

Cultivars with levels of reducing sugars as low as reasonably achievable should be selected taking into account regional and seasonal variability for high temperature cooking processes such as frying and baking.

5.1.3 Storage temperature and time

Control storage conditions from farm to factory; > 6 °C has been identified as a current good manufacturing practice for long storage for processing. Avoid using potatoes that have been subject to excessive low-temperature sweetening during storage (at or below 6 °C) for frying, roasting and oven-baking. In cold weather protect potatoes from cold air. Avoid leaving deliveries of potatoes standing outside (unprotected) overnight in freezing conditions.

NOTE Some cultivars are less prone than others to low temperature sweetening.

5.1.4 Reconditioning temperature and time

Potatoes that have been stored at low temperatures should be reconditioned over a period of a few weeks at higher temperatures (e.g. 12 °C – 15 °C). The decision to recondition stored potatoes, as well as decisions on the length of time needed for reconditioning, should be made on the basis of the results of fry testing.

5.1.5 Immature tubers

These tubers have higher reducing sugar levels and produce darker fried products with potentially higher levels of acrylamide. The presence of immature tubers should be avoided by selecting, sorting or grading of potatoes before processing.

5.1.6 Sprout suppressants

These shall not be allowed for use.

5.1.7 Screening incoming lots

Manufacturers of fried potato chips and potato crisps should where feasible screen incoming lots by measuring reducing sugar content or assessing the colour of a fried sample. In particular, fry test potatoes that have been stored at low temperatures for long periods of time. When using cultivars with not sufficiently low reducing sugar contents, reconditioning and blanching before high temperature cooking processes, and vacuum frying for heating may lower the level of acrylamide.

5.2 Control and/ or addition of other ingredients

5.2.1 Food additives used shall be applied in accordance with CODEX STAN 192. Formal safety assessments, efficacy-in-use demonstration and regulatory approval shall be needed for potential new additives and processing aids.

5.2.2 For reconstituted or formed potato-based snacks produced from potato doughs, other ingredients with lower reducing sugar/asparagine content may be used in some products to partially replace the potato e.g. rice flour.

5.2.3 Asparaginase enzyme may be added to reduce acrylamide in prefabricated potato crisps. However, the amount of asparagines in the raw potato product is generally so high that in order to achieve a meaningful reduction in acrylamide a large amount of asparaginase should be added. This may preclude the use of the enzyme for some potato products. Treatment with various other reagents e.g. sodium pyrophosphate and calcium salts prior to the frying stage may also be applied to reduce acrylamide formation.

5.2.4 The use of reducing sugars as a browning agent, spice carrier or coating shall be avoided where possible because they can cause the formation of significant levels of acrylamide.

5.3 Food processing

5.3.1 Decreasing of the surface area by cutting potatoes into thicker slices may be employed to reduce acrylamide in potato products. Removal of fines (fine pieces of potato) before or after frying has been shown to reduce levels of acrylamide in fried or roasted potatoes.

5.3.2 Washing, soaking, blanching or par-boiling treatments may be used to leach the asparagine/reducing sugar reactants from the potato before the cooking step. However, the water used shall meet the requirements of potable water. Various reagents for lowering pH may also be added during the latter stages of blanching to further reduce levels of acrylamide, for example by treatment of potato chips with sodium acid pyrophosphate, calcium salts and the salts of a number of other di- and trivalent cations.

NOTE 1 This process has been shown to reduce acrylamide formation in potato chips made from potato dough and blanching in sodium chloride solution (though this method may increase dietary exposure to sodium).

NOTE 2 Blanching or soaking potatoes reduce acrylamide levels but can also have an adverse effect on the flavour and texture of the final product. Blanching can also lead to leaching of vitamin C and minerals from potatoes. A blanching step before frying/roasting may lower the fat content of the final product, but there is contradictory information on this subject.

NOTE 3 Blanching may also be unsuitable for some products e.g. potato crisps, as it may cause unacceptable moisture uptake, leading to loss of consistency, crispness or possible microbiological spoilage.

5.3.3. Acrylamide levels in potato crisps may be reduced by controlling the frying temperature. Vacuum frying may offer the opportunity to reduce acrylamide levels in crisps made from potatoes with high reducing sugar content. Rapid cooling of potato crisps that are cooked by flash frying may also reduce levels of acrylamide in the final product. The use of in-line optical sorting to remove dark coloured crisps has been proved to be an effective measure to reduce acrylamide. Par-cooking, far-infrared heating and dry steam treatments used to make low fat crisps may also reduce acrylamide.

5.3.4 In order to achieve significant reductions in the acrylamide content of fried potato chips, when cooking the product immediately prior to consumption, set the initial oil temperature to no more than 170-175 °C and cook to a golden-yellow rather than a golden-brown colour. Depending on the heating power of the fryer, the amount of potato immersed in the oil should aim to give an actual frying temperature starting from about 140 °C and ending at about 160 °C. A bigger long-lasting temperature drop after addition of the potato will increase the fat uptake, and a higher end temperature will result in excessive acrylamide formation. The oil used for frying shall meet the requirements of the relevant African Standards.

5.3.5 Manufacturers of prefabricated par fried potato chips should ensure that their on-pack cooking instructions are consistent with the need to minimise acrylamide formation. Where frying is one of the on-pack label for “Prefabricated” potato chips, the recommended frying temperature should not be greater than 175 °C. The cooking instructions should also mention that consumers should reduce the cooking time when cooking small amounts and that they should cook potato chips to a golden-yellow colour.

5.3.6 Some fried potato chips or prefabricated potato products are manufactured with a view for storage under refrigeration rather than frozen conditions. Storage at these conditions may be conducive to low-temperature sweetening due to residual amylase activity which leads to reducing sugar formation from starch. In order to fully inactivate the amylase activity, blanching shall be done.

6 Consumer practices

6.1 Consumers should be advised to avoid over-heating potato and potato-based foodstuffs when using high temperature cooking processes. Such advice could include recommendations that potato chips and roast potatoes be cooked to a golden-yellow rather than golden-brown colour, whilst still ensuring that the food is fully cooked.

6.2 Consumers should avoid storing potatoes intended for high-temperature cooking under cold and/or refrigerated conditions.

6.3. Where relevant, industry should endeavour to provide advice to consumers on appropriate cooking and handling instructions that can help to mitigate acrylamide formation in the product.

7 Criteria for conformity

A lot shall be declared as acceptable if the reduction of acrylamide in potato products conform to the provisions of this Code of practice.

Bibliography

EAS 777:2012, *Reduction of acrylamide in potato products — Code of practice*